



# MATERIAL SAFETY DATA SHEET

Prepared to U.S. OSHA, CMA, ANSI and Canadian WHMIS Standards

*GAS TECH  
CALIBRATION*

## 1. PRODUCT IDENTIFICATION

**CHEMICAL NAME; CLASS: NON-FLAMMABLE GAS MIXTURE**

Containing One or More of the Following Components in a Nitrogen Balance Gas:  
Oxygen, 0.0015-23.5%; Propane, 0-1.1%; n-Pentane, 0-0.75%; n-Hexane, 0-0.48%;  
Carbon Monoxide, 0.0005-1.0%; Hydrogen Sulfide, 0.001-0.025%

SYNONYMS: Not Applicable

CHEMICAL FAMILY NAME: Not Applicable

FORMULA: Not Applicable

Document Number: 50016

USEPA SF



1288520

Note: The Material Safety Data Sheet is for this gas mixture supplied in cylinders with 33 cubic feet (935 liters) or less gas capacity (DOT - 39 cylinders). This MSDS has been developed for various gas mixtures with the composition of components within the ranges listed in Section 2 (Composition and Information on Ingredients). Refer to the product label for information on the actual composition of the product.

<b>PRODUCT USE:</b>	Calibration of Monitoring and Research Equipment
<b>SUPPLIER/MANUFACTURER'S NAME:</b>	AIR LIQUIDE AMERICA CORPORATION
<b>ADDRESS:</b>	821 Chesapeake Drive Cambridge, MD 21613
<b>EMERGENCY PHONE:</b>	CHEMTREC: 1-800-424-9300
<b>BUSINESS PHONE:</b>	1-410-228-6400
	General MSDS Information 1-713/868-0440
	Fax on Demand: 1-800/231-1366

## 2. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS #	Mole %	EXPOSURE LIMITS IN AIR					
			ACGIH		OSHA			OTHER
			TLV ppm	STEL ppm	PEL ppm	STEL ppm	IDLH ppm	
Oxygen	7782-44-7	0.0015 - 23.5%	There are no specific exposure limits for Oxygen. Oxygen levels should be maintained above 19.5%.					
Propane	74-98-6	0 - 1.1%	Simple Asphyxiant	NE	1000	NE	2100	NIOSH REL: 1000 DFG MAK: 1000 ppm
n-Pentane	109-66-0	0 - 0.75%	600	750	1000  600 (Vacated 1989 PEL)	750 (Vacated 1989 PEL)	1500	NIOSH REL: 120 TWA: 610, C (15 min) DFG MAK: 1000
n-Hexane	110-54-3	0 - 0.48%	50	NE	500  50 (Vacated 1989 PEL)	NE	1100	NIOSH REL: 50  DFG MAK: 50

NE = Not Established.

C = Ceiling Limit.

See Section 16 for Definitions of Terms Used.

NOTE: All WHMIS required information is included. It is located in appropriate sections based on the ANSI Z400.1-1993 format.

**2. COMPOSITION and INFORMATION ON INGREDIENTS (Continued)**

CHEMICAL NAME	CAS #	mole %	EXPOSURE LIMITS IN AIR					
			ACGIH		OSHA			OTHER
			TLV ppm	STEL ppm	PEL ppm	STEL ppm	IDLH ppm	
Hydrogen Sulfide	7783-06-4	0.001-0.025 %	10	15	20 C 10 (Vacated 1989 PEL)	50 ppm (10 minute maximum peak) 15 (Vacated 1989 PEL)	100	NIOSH REL: 10 ppm C (10 minutes) DFG-MAK: 15 ppm
Carbon Monoxide	630-08-0	0.0005 - 1.0%	25	NE	50 35 (Vacated 1989 PEL)	200 C (Vacated 1989 PEL)	1200	NIOSH REL: 35 (TWA); 200 C DFG MAK: 30
Nitrogen	7727-37-9	Balance	There are no specific exposure limits for Nitrogen. Nitrogen is a simple asphyxiant (SA). Oxygen levels should be maintained above 19.5%.					

NE = Not Established.

C = Ceiling Limit.

See Section 16 for Definitions of Terms Used.

NOTE: All WHMIS required information is included. It is located in appropriate sections based on the ANSI Z400.1-1993 format.

**3. HAZARD IDENTIFICATION**

**EMERGENCY OVERVIEW:** This product is a colorless gas which has a rotten-egg odor (due to the presence of Hydrogen Sulfide). The odor cannot be relied on as an adequate warning of the presence of this product, because olfactory fatigue occurs after over-exposure to Hydrogen Sulfide. Hydrogen Sulfide and Carbon Monoxide (another component of this gas mixture) are toxic to humans in relatively low concentrations. Over-exposure to this gas mixture can cause skin or eye irritation, nausea, dizziness, headaches, collapse, unconsciousness, coma, and death. Components of this product (Propane, n-Pentane, and n-Hexane) can cause anesthetic or peripheral neuropathy effects. Additionally, releases of this product may produce oxygen-deficient atmospheres (especially in small confined spaces or other poorly-ventilated environments); individuals in such atmospheres may be asphyxiated.

**SYMPTOMS OF OVER-EXPOSURE BY ROUTE OF EXPOSURE:** The most significant route of over-exposure for this product is by Inhalation.

**INHALATION:** Due to the small size of an individual cylinder of this product, no unusual health effects from over-exposure to the product are anticipated under routine circumstances of use. A significant health hazard associated with this product is the potential of inhalation of Hydrogen Sulfide, a component of this gas mixture. Such over-exposures may occur if this product is used in a confined space or other poorly-ventilated area. Over-exposures to Hydrogen Sulfide can cause dizziness, headache, and nausea. Exposure to this component can result in respiratory arrest, coma, or unconsciousness. Continuous inhalation of low concentrations of Hydrogen Sulfide may cause olfactory fatigue, so that the odor is no longer an effective warning of the presence of this gas. A summary of exposure concentrations and observed effects are as follows

**CONCENTRATION OF HYDROGEN SULFIDE**

0.3-30 ppm

50 ppm

Slightly higher than 50 ppm  
100-150 ppm**OBSERVED EFFECT**

Odor is obvious and unpleasant.

Eye irritation. Dryness and irritation of nose, throat.

Irritation of the respiratory system.  
Temporary loss of smell.**HAZARDOUS MATERIAL INFORMATION SYSTEM****HEALTH**

(BLUE)

3

**FLAMMABILITY**

(RED)

0

**REACTIVITY**

(YELLOW)

0

**PROTECTIVE EQUIPMENT**

B

EYES

RESPIRATORY

HANDS

BODY

See Section 8

For routine industrial applications

### 3. HAZARD IDENTIFICATION (Continued)

#### CONCENTRATION OF HYDROGEN SULFIDE

200-250 ppm

300-500

500 ppm

&gt; 600 ppm

&gt; 1000 ppm

NOTE:

#### OBSERVED EFFECT

Headache, vomiting nausea. Prolonged exposure may lead to lung damage. Exposures of 4-8 hours can be fatal.

Swifter onset of symptoms. Death occurs in 1-4 hours.

Headache, excitement, staggering, and stomach ache after brief exposure. Death occurs within 0.5 - 1 hour of exposure.

Rapid onset of unconsciousness, coma, death.

Immediate respiratory arrest.

This product contains a maximum of 250 ppm Hydrogen Sulfide. The higher concentration values here are presented to delineate the complete health effects which have been observed for humans after exposure to Hydrogen Sulfide.

Inhalation over-exposures to atmospheres containing more than the Threshold Limit Value of Carbon Monoxide (25 ppm), another component of this gas mixture, can result in serious health consequences. Carbon Monoxide is classified as a chemical asphyxiant, producing a toxic action by combining with the hemoglobin of the blood and replacing the available oxygen. Through this replacement, the body is deprived of the required oxygen, and asphyxiation occurs.

Since the affinity of Carbon Monoxide for hemoglobin is about 200-300 times that of oxygen, only a small amount of Carbon Monoxide will cause a toxic reaction to occur. Carbon Monoxide exposures in excess of 50 ppm will produce symptoms of poisoning if breathed for a sufficiently long time. If this product is released in a small, poorly ventilated area (i.e. an enclosed or confined space), symptoms which may develop include the following:

#### CONCENTRATION OF CARBON MONOXIDE

All exposure levels:

200 ppm:

400 ppm:

1,000 -2000 ppm:

200-2500 ppm:

&gt;2500 ppm:

#### OBSERVED EFFECT

Over-exposure to Carbon Monoxide can be indicated by the lips and fingernails turning bright red.

Slight symptoms (i.e. headache) after several hours of exposure.

Headache and discomfort experienced within 2-3 hours of exposure.

Within 30 minutes, slight palpitations of the heart occurs. Within 1.5 hours, there is a tendency to stagger.

Within 2 hours, there is mental confusion, headaches, and nausea.

Unconsciousness within 30 minutes.

Potential for collapse and death before warning symptoms.

Another hazard associated with this product is the potential for anesthetic and peripheral neuropathy effects after inhalation over-exposures to Propane, n-Pentane and n-Hexane (components of this product). Specific human over-exposure data are available for n-Pentane and n-Hexane, as follows:

#### CONCENTRATION OF n-PENTANE

Brief (10 minute) up to 5,000 ppm:

Higher than 5,000 ppm:

Long term:

#### OBSERVED EFFECT

No symptoms.

Exhilaration, dizziness and headache can occur.

Can cause chronic neurological disorder causing damage to the nerves in the hands and feet (peripheral neuropathy).

#### CONCENTRATION OF n-HEXANE

Brief (10 minute) at 1,500 ppm:

5000 ppm:

Long term at 500 ppm:

#### OBSERVED EFFECT

Irritation of the respiratory tract, nausea and headache.

Dizziness and drowsiness can occur.

Can affect the nerves in the arms and legs. Effects include numbing or tingling sensations in the fingers and toes, tiredness, muscle weakness, cramps and spasms in the leg, difficulty in holding objects or walking, abdominal pains, loss of appetite, weight loss. More serious exposures can cause damage to the nerves in the hands and feet (peripheral neuropathy).

Eyes and Vision:

Abnormal color perception and pigment changes in the eyes have been reported among industrial workers exposed to 423-1280 ppm for 5 years or more.

Blood Cells:

Mild forms of anemia have also been associated with exposure to hexane. These are of temporary nature.

### 3. HAZARD IDENTIFICATION (Continued)

Additionally, if mixtures of this product contain less than 19.5% Oxygen and are released in a small, poorly ventilated area (i.e. an enclosed or confined space), an oxygen-deficient environment may occur. Individuals breathing such an atmosphere may experience symptoms which include headaches, ringing in ears, dizziness, drowsiness, unconsciousness, nausea, vomiting, and depression of all the senses. Under some circumstances of over-exposure, death may occur. The following effects associated with various levels of oxygen are as follows:

#### **CONCENTRATION OF OXYGEN**

12-16% Oxygen:

10-14% Oxygen:

6-10% Oxygen:

Below 6%:

#### **OBSERVED EFFECT**

Breathing and pulse rate increased, muscular coordination slightly disturbed.

Emotional upset, abnormal fatigue, disturbed respiration.

Nausea, vomiting, collapse, or loss of consciousness.

Convulsive movements, possible respiratory collapse, and death.

**SKIN and EYE CONTACT:** Hydrogen Sulfide, a component of this gas mixture, may be irritating to the skin. Inflammation and irritation of the eyes can occur at very low airborne concentration of Hydrogen Sulfide (less than 10 ppm). Exposure over several hours may result in "gas eyes" or "sore eyes" with symptoms of scratchiness, irritation, tearing and burning. Above 50 ppm of Hydrogen Sulfide, there is an intense tearing, blurring of vision, and pain when looking at light. Over-exposed individuals may see rings around bright lights. Most symptoms disappear when exposure ceases. However, in serious cases, the eye can be permanently damaged.

**HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in Lay Terms.** Over-exposure to this gas mixture may cause the following health effects:

**ACUTE:** Due to the small size of the individual cylinder of this product, no unusual health effects from exposure to the product are anticipated under routine circumstances of use. However, Hydrogen Sulfide and Carbon Monoxide (components of this gas mixture) are toxic to humans. Over-exposure to this gas mixture can cause nausea, dizziness, headaches, collapse, unconsciousness, coma, and death. Due to the presence of Hydrogen Sulfide, over-exposures to this gas mixture can also irritate the skin and eyes; severe eye contamination can result in blindness. Inhalation over-exposures to other components of this gas mixture (Propane, n-Pentane, and n-Hexane) can cause anesthetic effects and motor neuropathy (i.e. pain and tingling in feet and hands).

**CHRONIC:** Abnormal color perception and pigment changes in the eyes have been reported among persons exposed to 420 -1300 ppm of n-Hexane for five years. Additionally, long-term exposure to low levels of n-Hexane or n-Pentane can affect the nerves in the arms and legs. Effects include numbing or tingling sensation; tiredness, cramps, spasms in legs, difficulty holding objects or walking, loss of appetite and weight loss. Pentane isomers, such as n-Pentane, and Propane can cause sensitization of the heart to epinephrine. Refer to Section 11 (Toxicology Information) for additional information on the components of this product.

**TARGET ORGANS:** Respiratory system, blood system, central nervous system effects, cardiovascular system, reproductive system, skin, eyes.

### 4. FIRST-AID MEASURES

**RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO THIS PRODUCT WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. At a minimum, Self-Contained Breathing Apparatus must be worn.**

No unusual health effects are anticipated after exposure to this product, due to the small cylinder size. If any adverse symptom develops after over-exposure to this product, remove victim(s) to fresh air as quickly as possible. Only trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation if necessary.

**SKIN EXPOSURE:** If irritation of the skin develops after exposure to this gas mixture, immediately begin decontamination with running water. Minimum flushing is for 15 minutes. Remove exposed or contaminated clothing, taking care not to contaminate eyes. Victim must seek immediate medical attention.

**EYE EXPOSURE:** If irritation of the eye develops after exposure to this gas mixture, open victim's eyes while under gentle running water. Use sufficient force to open eyelids. Have victim "roll" eyes. Minimum flushing is for 15 minutes. Seek medical assistance immediately, preferably an ophthalmologist.

Victim(s) who experience any adverse effect after over-exposure to this product must be taken for medical attention. Rescuers should be taken for medical attention if necessary. Take a copy of the label and the MSDS to physician or other health professional with victim(s).



## 5. FIRE-FIGHTING MEASURES

**FLASH POINT, (method):** Not applicable.

**AUTOIGNITION TEMPERATURE:** Not applicable.

**FLAMMABLE LIMITS (in air by volume, %):**

Lower (LEL): Not applicable.

Upper (UEL): Not applicable.

**FIRE EXTINGUISHING MATERIALS:** Non-flammable gas mixture. Use extinguishing media appropriate for surrounding fire.

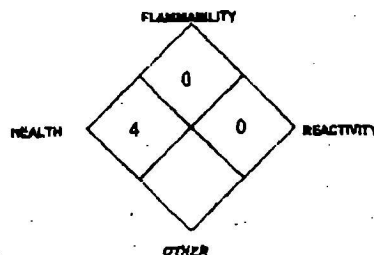
**UNUSUAL FIRE AND EXPLOSION HAZARDS:** This gas mixture contains toxic gases, Hydrogen Sulfide and Carbon Monoxide, and presents an extreme health hazard to firefighters. This gas mixture is not flammable; however, containers, when involved in fire, may rupture or burst in the heat of the fire.

**Explosion Sensitivity to Mechanical Impact:** Not Sensitive.

**Explosion Sensitivity to Static Discharge:** Not Sensitive.

**SPECIAL FIRE-FIGHTING PROCEDURES:** Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment.

### NFPA RATING



## 6. ACCIDENTAL RELEASE MEASURES

**LEAK RESPONSE:** Due to the small size and content of the cylinder, an accidental release of this product presents significantly less risk of over-exposure to Hydrogen Sulfide and Carbon Monoxide, the toxic components of this product, and other safety hazards related to the remaining components of this product, than a similar release from a larger cylinder. However, as with any chemical release, extreme caution must be used during emergency response procedures. In the event of a release in which the atmosphere is unknown, and in which other chemicals are potentially involved, evacuate immediate area. Such releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a leak, clear the affected area, protect people, and respond with trained personnel.

For emergency disposal, secure the cylinder and slowly discharge the gas to the atmosphere in a well-ventilated area or outdoors. Allow the gas mixture to dissipate. If necessary, monitor the surrounding area (and the original area of the release) for Hydrogen Sulfide, Carbon Monoxide, and Oxygen. Hydrogen Sulfide and Carbon Monoxide level must be below exposure level listed in Section 2 (Composition and Information on Ingredients) and Oxygen levels must be above 19.5% before non-emergency personnel are allowed to re-enter area.

If leaking incidentally from the cylinder, contact your supplier.

## 7. HANDLING and USE

**WORK PRACTICES AND HYGIENE PRACTICES:** Be aware of any signs of dizziness or fatigue; exposures to fatal concentrations of this product could occur without any significant warning symptoms, due to olfactory fatigue or oxygen deficiency. Do not attempt to repair, adjust, or in any other way modify cylinders containing a gas mixture with Hydrogen Sulfide or Carbon Monoxide. If there is a malfunction or another type of operational problem, contact nearest distributor immediately. Eye wash stations/safety showers should be near areas where this product is used or stored. All work operations should be monitored in such a way that emergency personnel can be immediately contacted in the event of a release. All work practices should minimize releases of Hydrogen Sulfide and Carbon Monoxide-containing gas mixtures.

**STORAGE AND HANDLING PRACTICES:** Cylinders should be firmly secured to prevent falling or being knocked-over. Cylinders must be protected from the environment, and preferably kept at room temperature (approximately 21°C, 70°F). Cylinders should be stored in dry, well-ventilated areas, away from sources of heat, ignition, and direct sunlight. Protect cylinders against physical damage.

Full and empty cylinders should be segregated. Use a first-in, first-out inventory system to prevent full containers from being stored for long periods of time. These cylinders are not refillable. **WARNING!** Do not refill DOT 39 cylinders. To do so may cause personal injury or property damage.

**SPECIAL PRECAUTIONS FOR HANDLING GAS CYLINDERS:** **WARNING!** Compressed gases can present significant safety hazards. During cylinder use, use equipment designed for these specific cylinders. Ensure all lines and equipment are rated for proper service pressure.

## 7. HANDLING and USE (Continued)

**PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT:** Follow practices indicated in Section 6 (Accidental Release Measures). Make certain that application equipment is locked and tagged-out safely. Always use product in areas where adequate ventilation is provided.

## 8. EXPOSURE CONTROLS - PERSONAL PROTECTION

**VENTILATION AND ENGINEERING CONTROLS:** No special ventilation systems or engineering controls are needed under normal circumstances of use. As with all chemicals, use this product in well-ventilated areas. If this product is used in a poorly-ventilated area, install automatic monitoring equipment to detect the levels of Oxygen, Hydrogen Sulfide, and Carbon Monoxide.

**RESPIRATORY PROTECTION:** No special respiratory protection is required under normal circumstances of use. Use supplied air respiratory protection if Carbon Monoxide levels exceed the exposure levels given in Section 2 (Composition and Information on Ingredients) or if oxygen levels are below 19.5%, or if either level is unknown during emergency response to a release of this product. If respiratory protection is required for emergency response to this product, follow the requirements of the Federal OSHA Respiratory Protection Standard (29 CFR 1910.134) or equivalent State standards. The following NIOSH respiratory protection recommendations for Hydrogen Sulfide and Carbon Monoxide are provided for further information.

### NIOSH/OSHA RECOMMENDATIONS FOR HYDROGEN SULFIDE CONCENTRATIONS IN AIR:

**UP TO 100 ppm:** Powered air-purifying respirator with cartridge(s) to protect against hydrogen sulfide; or gas mask with canister to protect against hydrogen sulfide; or SAR; or full-facepiece SCBA.

**Emergency or Planned Entry into Unknown Concentration or IDLH Conditions:** Positive pressure, full-facepiece SCBA; or positive pressure, full-facepiece SAR with an auxiliary positive pressure SCBA.

**Escape:** Gas mask with canister to protect against hydrogen sulfide; or escape-type SCBA

**NOTE:** The IDLH concentration for Hydrogen Sulfide is 100 ppm.

### NIOSH/OSHA RECOMMENDATIONS FOR CARBON MONOXIDE CONCENTRATIONS IN AIR:

**UP TO 350 ppm** Supplied Air Respirator (SAR)

**UP TO 875 ppm** Supplied Air Respirator (SAR) operated in a continuous flow mode.

**UP TO 1200 ppm** Gas mask with canister to protect against carbon monoxide; or full-facepiece SCBA; or full-facepiece Supplied Air Respirator (SAR).

**Emergency or Planned Entry into Unknown Concentration or IDLH Conditions:** Positive pressure, full-facepiece SCBA; or positive pressure, full-facepiece Supplied Air Respirator (SAR) with an auxiliary positive pressure SCBA.

**Escape:** Gas mask with canister to protect against carbon monoxide; or escape-type SCBA.

**NOTE:** End of Service Life Indicator (ESLI) required for gas masks.

**EYE PROTECTION:** Safety glasses.

**HAND PROTECTION:** No special protection is needed under normal circumstances of use.

**BODY PROTECTION:** No special protection is needed under normal circumstances of use.

## 9. PHYSICAL and CHEMICAL PROPERTIES

Unless otherwise specified, the following information is for Nitrogen, the main component of this gas mixture.

**GAS DENSITY @ 32°F (0°C) and 1 atm:** .072 lbs/ ft<sup>3</sup> (1.153 kg/m<sup>3</sup>)

**BOILING POINT:** -320.4°F (-195.8°C)

**FREEZING/MELTING POINT @ 10 psig:** -345.8°F (-210°C)

**SPECIFIC GRAVITY (air = 1) @ 70°F (21.1°C):** 0.906

**SOLUBILITY IN WATER vol/Vol @ 32°F (0°C) and 1 atm:** 0.023

**EVAPORATION RATE (nBuAc = 1):** Not applicable.

**ODOR THRESHOLD:** 0.13 ppm (Hydrogen Sulfide)

**VAPOR PRESSURE @ 70°F (21.1°C) (psig):** Not applicable.

**COEFFICIENT WATER/OIL DISTRIBUTION:** Not applicable.

**APPEARANCE AND COLOR:** This product is a colorless gas which has an rotten egg-like odor, due to the presence of Hydrogen Sulfide.

**pH:** Not applicable.

**MOLECULAR WEIGHT:** 28.01

**EXPANSION RATIO:** Not applicable.

**SPECIFIC VOLUME (ft<sup>3</sup>/lb):** 13.8

## 9. PHYSICAL and CHEMICAL PROPERTIES (Continued)

**HOW TO DETECT THIS SUBSTANCE (warning properties):** Continuous inhalation of low concentrations of Hydrogen Sulfide (a component of this gas mixture) may cause olfactory fatigue, so that there are no distinct warning properties. In terms of leak detection, fittings and joints can be painted with a soap solution to detect leaks, which will be indicated by a bubble formation. Wet lead acetate paper can be used for leak detection. The paper turns black in the presence of Hydrogen Sulfide. Cadmium chloride solutions can also be used. Cadmium solutions will turn yellow upon contact with Hydrogen Sulfide.

## 10. STABILITY and REACTIVITY

**STABILITY:** Normally stable in gaseous state.

**DECOMPOSITION PRODUCTS:** The thermal decomposition products of Propane, n-Hexane, and n-Pentane include carbon oxides. The decomposition products of Hydrogen Sulfide include water and sulfur oxides. The other components of this gas mixture do not decompose, per se, but can react with other compounds in the heat of a fire.

**MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE:** Titanium will burn in Nitrogen (the main component of this product). Lithium reacts slowly with Nitrogen at ambient temperatures. Components of this product (Hydrogen Sulfide, Propane, n-Pentane, n-Hexane) are also incompatible with strong oxidizers (i.e. chlorine, bromine pentafluoride, oxygen, oxygen difluoride, and nitrogen trifluoride). Carbon Monoxide is mildly corrosive to nickel and iron (especially at high temperatures and pressures). Hydrogen Sulfide is corrosive to most metals, because it reacts with these substances to form metal sulfides.

**HAZARDOUS POLYMERIZATION:** Will not occur.

**CONDITIONS TO AVOID:** Contact with incompatible materials. Cylinders exposed to high temperatures or direct flame can rupture or burst.

## 11. TOXICOLOGICAL INFORMATION

**TOXICITY DATA:** The following toxicology data are available for the components of this product:

**NITROGEN:** There are no specific toxicology data for Nitrogen. Nitrogen is a simple asphyxiant, which acts to displace oxygen in the

### n-PENTANE:

LD<sub>50</sub> (intravenous, mouse) = 448 mg/kg.  
LC<sub>50</sub> (inhalation, rat) = 384 g/m<sup>3</sup>/4 hours  
LCLo (inhalation, mouse) = 325 g/m<sup>3</sup>/2 hours

### n-HEXANE:

Eye, rabbit = 10 mg/ml mild  
TCLo (inhalation, rat) = 10,000 ppm/7 hr.  
TCLo (inhalation, rat) = 5000 ppm/20 hours; teratogenic effects  
LD50 (oral, rat) = 28710 mg/kg  
LDLo (intraperitoneal, rat) = 9100 mg/kg  
LCLo (inhalation, mouse) = 120,000 mg/kg  
LD50 (rat, oral) = 28,710 mg/kg

**ACUTE INHALATION (mouse):** 30,000 ppm, narcosis within 30 to 60 minutes; 35,000-40,000 ppm, convulsions and death.

**DERMAL (rabbit):** 2 to 5 ml/kg for 4 hours resulted in restlessness and discoordination; death occurred at 5 ml/kg.

**CHRONIC INHALATION (rat):** 400-600 ppm, 5 days/week, peripheral neuropathy in 45 days; 850 ppm for 143 days, loss of weight and degeneration of the sciatic nerve. (mouse): 250 ppm, peripheral neuropathy within 7 months; no effects at 100 ppm.

### PROPANE:

**Long-Term Inhalation:** No toxicity or abnormalities were observed when monkeys were exposed to approximately 750 ppm for 90 days. Similar results were obtained when monkeys were exposed to an aerosol spray containing 65% propane and isobutane.

### CARBON MONOXIDE:

TCLo (inhalation, mouse) = 65 ppm/24 hours (7-18 preg): rep. effects  
TCLo (inhalation, mouse) = 8 ppm/1 hour (female 8D post): ter. effects  
TCLo (inhalation, human) = 600 mg/m<sup>3</sup>/10 minutes  
LCLo (inhalation, man) = 4000 ppm/30 minutes  
TCLo (inhalation, man) = 650 ppm/45 minutes: central nervous system and blood system effects.  
LCLo (inhalation, human) = 5000 ppm/5 minutes  
LCLo (inhalation, dog) = 4000 ppm/46 minutes  
LCLo (inhalation, rabbit) = 4000 ppm  
LC<sub>50</sub> (inhalation, rat) = 1811 ppm/4 hours  
LC<sub>50</sub> (inhalation, guinea pig) = 2450 ppm/4 hours  
LC<sub>50</sub> (inhalation, guinea pig) = 5718 ppm/4 hours  
LCLo (inhalation, mammal) = 5000 ppm/5 minutes  
LD<sub>50</sub> (inhalation, wild bird) = 1334 ppm

### HYDROGEN SULFIDE:

LCLo (inhalation, human) = 800 ppm/30 minutes  
LDLo (inhalation, man) = 5.7 mg/kg; central nervous system, pulmonary effects  
LCLo (inhalation, human) = 800 ppm/5 minutes  
LC<sub>50</sub> (inhalation, rat) = 444 ppm  
LC<sub>50</sub> (inhalation, mouse) = 673 ppm/1 hour  
LCLo (inhalation, mammal) = 800 ppm/5 minutes

**SUSPECTED CANCER AGENT:** The components of this gas mixture are not found on the following lists: FEDERAL OSHA Z LIST, NTP, CAL/OSHA, and IARC; therefore, they are not considered to be, nor suspected to be, cancer-causing agents by these agencies.

**IRRITANCY OF PRODUCT:** Hydrogen Sulfide, a component of this gas mixture, is irritating to the eyes, and may be irritating to the skin.

## 11. TOXICOLOGICAL INFORMATION (Continued)

**SENSITIZATION OF PRODUCT:** The components of this gas mixture are not known to be skin or respiratory sensitizers. Pentane isomers (i.e. n-Pentane) and Propane can cause cardiac sensitization to epinephrine.

**REPRODUCTIVE TOXICITY INFORMATION:** Listed below is information concerning the effects of this gas mixture on the human reproductive system.

**Mutagenicity:** This gas mixture is not expected to cause mutagenic effects in humans.

**Embryotoxicity:** This gas mixture contains components that may cause embryotoxic effects in humans; however, due to the small total amount of the components, embryotoxic effects are not expected to occur.

**Teratogenicity:** This gas mixture is not expected to cause teratogenic effects in humans due to the small cylinder size and small total amount of all components. Carbon Monoxide, a component of this gas mixture which exists up to 1%, can cause teratogenic effects in humans. Severe exposure to Carbon Monoxide during pregnancy has caused adverse effects and the death of the fetus. In general, maternal symptoms are an indicator of the potential risk to the fetus since Carbon Monoxide is toxic to the mother before it is toxic to the fetus.

**Reproductive Toxicity:** This gas mixture is not expected to cause adverse reproductive effects in humans.

A mutagen is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generation lines. An embryotoxin is a chemical which causes damage to a developing embryo (i.e. within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A teratogen is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A reproductive toxin is any substance which interferes in any way with the reproductive process.

**MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE:** Pre-existing respiratory conditions may be aggravated by over-exposure to this product. Carbon Monoxide, a component of this gas mixture, can aggravate some diseases of the cardiovascular system, such as coronary artery disease and angina pectoris. Because of the presence of Hydrogen Sulfide, n-Hexane or n-Pentane in this product, central nervous system conditions, eye disorders, or skin problems may be aggravated by over-exposure to this product.

**RECOMMENDATIONS TO PHYSICIANS:** Treat symptoms and eliminate over-exposure. Hyperbaric oxygen is the most efficient antidote to Carbon Monoxide poisoning, the optimum range being 2-2.5 atm. A special mask, or, preferably, a compression chamber to utilize oxygen at these pressures is required. Avoid administering stimulant drugs. Be observant for initial signs of pulmonary edema in the event of severe inhalation over-exposures.

**BIOLOGICAL EXPOSURE INDICES (BEIs):** Biological Exposure Indices (BEIs) are applicable for this product, as follows:

BIOLOGICAL EXPOSURE INDICES (BEIs) for components of this product are as follows:		
CHEMICAL DETERMINANT	SAMPLING TIME	BEI
CARBON MONOXIDE • Carboxyhemoglobin in blood • Carbon monoxide in end-exhaled air	• End of shift • End of shift	• 3.5% of hemoglobin • 20 ppm
n-HEXANE • 2,5-Hexanedione in urine • n-Hexane in end-exhaled air	• End of shift	• 5 mg/g creatinine • Refer to current TLV list.

## 12. ECOLOGICAL INFORMATION

**ENVIRONMENTAL STABILITY:** The gas will be dissipated rapidly in well-ventilated areas. The following environmental data are applicable to the components of this product.

**OXYGEN:** Water Solubility = 1 volume Oxygen/32 volumes water at 20°C. Log  $K_{ow}$  = -0.85

**PROPANE:** Log  $K_{ow}$  = 2.38. Water Solubility = 82.4 ppm; 25°C. Propane is readily degraded by soil bacteria.

**PENTANE:** Log  $K_{ow}$  = 3.39. Water Solubility = 38.5 mg/L. LOG BCF (n-pentane) = calculated, 1.80 and 2.35, respectively. Photolysis, hydrolysis, and bioconcentration are not anticipated to be important fate processes. Biodegradation and soil adsorption are anticipated to be more important processes for this compound.

**n-HEXANE:** Log  $K_{ow}$  = 3.90-4.11. Water Solubility = 9.5 mg/L. Estimated Bioconcentration Factor = 2.24 and 2.89. Bioconcentration in aquatic organisms is low. Hexane is volatile. Rapid volatilization from water and soil is anticipated for this compound. Hexane will float in slick on surface of the water.

**HYDROGEN SULFIDE:** Water Solubility = 1 g/242 mL at 20°C.

**CARBON MONOXIDE:** Water solubility = 3.3 mL/100 cc at 0 °C, 2.3 mL at 20°C.

**NITROGEN:** Water Solubility = 2.4 volumes Nitrogen/100 volumes water at 0°C; 1.8 volumes Nitrogen/100 volumes water at 20°C.



## 12. ECOLOGICAL INFORMATION (Continued)

**EFFECT OF MATERIAL ON PLANTS or ANIMALS:** No evidence is currently available on this product's effects on plant and animal life. Hydrogen Sulfide and Carbon Monoxide, components of this product, can be deadly to exposed animal life, producing symptoms similar to those experienced by humans. This gas mixture may also be harmful to plant life.

**EFFECT OF CHEMICAL ON AQUATIC LIFE:** No evidence is currently available on this product's effects on aquatic life. The presence of more than a trace of Carbon Monoxide (a component of this product) is a hazard to fish. The following aquatic toxicity data are available for Hydrogen Sulfide (another component of this gas mixture):

TLm (Asellus sp.) = 0.111 mg/L/96 hour

TLm (Crangonyx sp.) = 1.07 mg/L/96 hour

TLm (Gammarus) = 0.84 mg/L/96 hour

LC<sub>50</sub> (fly inhalation) = 380 mg/m<sup>3</sup>/960 minutes

LC<sub>50</sub> (fly inhalation) = 1500 mg/m<sup>3</sup>/77 minutes

TLm (Lepomis macrochirus, bluegill sunfish) = 0.0478 mg/L/96 hour

TLm (Lepomis macrochirus, bluegill sunfish) = 0.0448 mg/L/96 hour at 21-22 °C

TLm (Pimephales promelas, fathead minnow) = 0.0071-0.55 mg/L/96 hour

TLm (Salvelinus fontinalis, brook trout) = 0.0216-0.038 mg/L/96 hour at 8-12.5 °C

## 13. DISPOSAL CONSIDERATIONS

**PREPARING WASTES FOR DISPOSAL:** Waste disposal must be in accordance with appropriate Federal, State, and local regulations. Cylinders with undesired residual product may be safely vented outdoors with the proper regulator. For further information, refer to Section 16 (Other Information).

## 14. TRANSPORTATION INFORMATION

**THIS MATERIAL IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.**

**PROPER SHIPPING NAME:**

Compressed gases, n.o.s. (Nitrogen, Hydrogen Sulfide)

**HAZARD CLASS NUMBER and DESCRIPTION:** 2.2 (Non-Flammable Gas)

**UN IDENTIFICATION NUMBER:**

UN 1956

**PACKING GROUP:**

Not applicable.

**DOT LABEL(S) REQUIRED:**

Non-Flammable Gas

**NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (1996):** 126

**MARINE POLLUTANT:** The components of this gas mixture are not classified by the DOT as Marine Pollutants (as defined by 49 CFR 172.101, Appendix B).

**SPECIAL SHIPPING INFORMATION:** Cylinders should be transported in a secure position, in a well-ventilated vehicle. The transportation of compressed gas cylinders in automobiles or in closed-body vehicles can present serious safety hazards. If transporting these cylinders in vehicles, ensure these cylinders are not exposed to extremely high temperatures (as may occur in an enclosed vehicle on a hot day). Additionally, the vehicle should be well-ventilated during transportation.

**Note:** DOT 39 Cylinders ship in a strong outer carton (overpack). Pertinent shipping information goes on the outside of the overpack. DOT 39 Cylinders do not have transportation information on the cylinder itself.

**TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS:** THIS MATERIAL IS CONSIDERED AS DANGEROUS GOODS. Use the above information for the preparation of Canadian Shipments.

## 15. REGULATORY INFORMATION

**SARA REPORTING REQUIREMENTS:** This product is subject to the reporting requirements of Sections 302, 304, and 313 of Title III of the Superfund Amendments and Reauthorization Act, as follows:

COMPONENT	SARA 302	SARA 304	SARA 313
Oxygen	NO	NO	NO
Propane	NO	NO	NO
n-Pentane	NO	NO	NO
n-Hexane	NO	YES	YES
Carbon Monoxide	NO	NO	NO
Nitrogen	NO	NO	NO
Hydrogen Sulfide	YES	YES	YES



## 15. REGULATORY INFORMATION (Continued)

**SARA THRESHOLD PLANNING QUANTITY:** Hydrogen Sulfide = 500 lbs.

**TSCA INVENTORY STATUS:** The components of this gas mixture are listed on the TSCA Inventory.

**CERCLA REPORTABLE QUANTITY (RQ):** A statutory 1 pound RQ is applicable to n-Hexane until this quantity is adjusted (as a Clean Air Act, Section 112(b) hazardous air pollutant). Hydrogen Sulfide = 100 lbs.

**OTHER U.S. FEDERAL REGULATIONS:**

- Hydrogen Sulfide, Carbon Monoxide, Propane, n-Pentane and n-Hexane are subject to the reporting requirements of CFR 29 1910.1000.
- Hydrogen Sulfide, Propane and n-Pentane are subject to the reporting requirements of Section 112(r) of the Clean Air Act. The Threshold Quantity for each of these gases is 10,000 pounds and so this mixture will not be affected by the regulation.
- Depending on specific operations involving the use of this gas mixture, the regulations of the Process Safety Management of Highly Hazardous Chemicals may be applicable (29 CFR 1910.119). Hydrogen Sulfide is listed in Appendix A of this regulation. The Threshold Quantity for Hydrogen Sulfide under this regulation is 1500 lbs.
- This gas mixture does not contain any Class I or Class II ozone depleting chemicals (40 CFR part 82).
- Nitrogen, Oxygen and n-Hexane are not listed Regulated Substances, per 40 CFR, Part 68, of the Risk Management for Chemical Releases. Hydrogen Sulfide is listed under this regulation in Table 1 as a Regulated Substance (Toxic Substance), in quantities of 10,000 lbs (4,553 kg) or greater. Carbon Monoxide, Propane and n-Pentane are listed under this regulation in Table 3, as Regulated Substances (Flammable), in quantities of 10,000 lbs (4,553 kg) or greater, and so this mixture will not be affected by the regulation.

**OTHER CANADIAN REGULATIONS:** This gas mixture is categorized as a Controlled Product, Hazard Classes A and D2A, as per the Controlled Product Regulations.

**STATE REGULATORY INFORMATION:** The components of this gas mixture are covered under the following specific State regulations:

**Alaska - Designated Toxic and Hazardous Substances:** Carbon Monoxide, Propane, n-Pentane, n-Hexane, Hydrogen Sulfide.

**California - Permissible Exposure Limits for Chemical Contaminants:** Carbon Monoxide, Nitrogen, Propane, n-Pentane, n-Hexane, Hydrogen Sulfide.

**Florida - Substance List:** Oxygen, Carbon Monoxide, n-Pentane, n-Hexane, Hydrogen Sulfide.

**Illinois - Toxic Substance List:** Carbon Monoxide, Propane, n-Pentane, n-Hexane, Hydrogen Sulfide.

**Kansas - Section 302/313 List:** No.

**Massachusetts - Substance List:** Oxygen, Carbon Monoxide, Propane, n-Pentane, n-Hexane, Hydrogen Sulfide.

**Minnesota - List of Hazardous Substances:** Carbon Monoxide, Propane, n-Pentane, n-Hexane, Hydrogen Sulfide.

**Missouri - Employer Information/Toxic Substance List:** n-Pentane, n-Hexane, Propane, Hydrogen Sulfide.

**New Jersey - Right to Know Hazardous Substance List:** Oxygen, Carbon Monoxide, Nitrogen, Propane, n-Pentane, n-Hexane.

**North Dakota - List of Hazardous Chemicals, Reportable Quantities:** Hydrogen Sulfide.

**Pennsylvania - Hazardous Substance List:** Oxygen, Carbon Monoxide, Nitrogen, Propane, n-Pentane, n-Hexane, Hydrogen Sulfide.

**Rhode Island - Hazardous Substance List:** Oxygen, Carbon Monoxide, Nitrogen, Propane, n-Pentane, n-Hexane, Hydrogen Sulfide.

**Texas - Hazardous Substance List:** n-Pentane, n-Hexane, Propane, Hydrogen Sulfide.

**West Virginia - Hazardous Substance List:** n-Pentane, n-Hexane, Propane, Hydrogen Sulfide.

**Wisconsin - Toxic and Hazardous Substances:** n-Pentane, n-Hexane, Propane, Hydrogen Sulfide.

**CALIFORNIA PROPOSITION 65:** Carbon Monoxide (a component of this product) is on the California Proposition 65 lists as a chemical known to the State of California to cause birth defects or other reproductive harm.

## 16. OTHER INFORMATION

### INFORMATION ABOUT DOT-39 NRC (Non-Refillable Cylinder) PRODUCTS

DOT 39 cylinders ship as hazardous materials when full. Once the cylinders are relieved of pressure (empty) they are not considered hazardous material or waste. Residual gas in this type of cylinder is not an issue because toxic gas mixtures are prohibited. Calibration gas mixtures typically packaged in these cylinders are Nonflammable n.o.s., UN 1958. A small percentage of calibration gases packaged in DOT 39 cylinders are flammable or oxidizing gas mixtures.

**16. OTHER INFORMATION (Continued)**

For disposal of used DOT-39 cylinders, it is acceptable to place them in a landfill if local laws permit. Their disposal is no different than that employed with other DOT containers such as spray paint cans, household aerosols, or disposable cylinders of propane (for camping, torch etc.). When feasible, we recommended recycling for scrap metal content. Air Liquide America will do this for any customer that wishes to return cylinders to us prepaid. All that is required is a phone call to make arrangements so we may anticipate arrival. Scrapping cylinders involves some preparation before the metal dealer may accept them. We perform this operation as a service to valued customers who want to participate.

**MIXTURES:** When two or more gases or liquefied gases are mixed, their hazardous properties may combine to create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an Industrial Hygienist or other trained person when you make your safety evaluation of the end product. Remember, gases and liquids have properties which can cause serious injury or death.

Further information about the handling of compressed gases can be found in the following pamphlets published by: Compressed Gas Association Inc. (CGA), 1725 Jefferson Davis Highway, Suite 1004, Arlington, VA 22202-4102. Telephone: (703) 412-0800.

- P-1 "Safe Handling of Compressed Gases in Containers"
- AV-1 "Safe Handling and Storage of Compressed Gases"
- "Handbook of Compressed Gases"

**PREPARED BY:**

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This Material Safety Data Sheet is offered pursuant to OSHA's Hazard Communication Standard, 29 CFR, 1910.1200. Other government regulations must be reviewed for applicability to this product. To the best of Air Liquide America Corporation's knowledge, the information contained herein is reliable and accurate as of this date; however, accuracy, suitability or completeness are not guaranteed and no warranties of any type, either express or implied, are provided. The information contained herein relates only to this specific product. If this product is combined with other materials, all component properties must be considered. Data may be changed from time to time. Be sure to consult the latest edition.